

Annual Report 2002

Interagency Regional Monitoring



Northwest Forest Plan - July 2003

Summary

Eight federal agencies have developed an implementation and effectiveness monitoring program encompassing more than 25 million acres of federal land managed by the Forest Service, Bureau of Land Management, and National Park Service in western Washington, Oregon, and northwest California.

This monitoring focuses on important regional-scale questions about old forests, listed species (northern spotted owls, marbled murrelets), watershed condition, tribal forest values and relations between federal agencies and Indian tribes, changing socioeconomic conditions in communities closely tied to federal lands, and compliance with meeting Northwest Forest Plan (the Plan) standards and guidelines.

The purpose of monitoring is to evaluate the success of the Plan in achieving these objectives:

- Protecting and enhancing habitat for late-successional and old-growth forests and related species;
- Restoring and maintaining the ecological integrity of watersheds and aquatic ecosystems; and,
- Maintaining sustainable production of renewable resources and contributing to socioeconomic well-being in rural communities.

Our report begins with a summary of program management and then highlights the development of a computer tool to assist with interpreting monitoring results. An overview of progress **during the 2002 calendar year**

by each component of the monitoring program follows, highlighting accomplishments during the 2002 field season and describing direction for future activities. The report concludes with an overview of budgets, participants and recent reports.

Highlights from the report include these monitoring efforts:

- ◆ A vegetation monitoring tool - How much old growth is there? Where is it located? What does it look like? These are examples of the basic questions addressed with a new easy-to-use computer application designed to summarize field data collected by Forest Service and Bureau of Land Management vegetation inventory programs in the Pacific Northwest.
- ◆ Implementing projects - Overall compliance in meeting the standards and guides of the Plan and its Record of Decision was 98% for the 21 density management and 11 other projects monitored; 21 fifth field watershed-scale assessments were also monitored in 2002.
- ◆ Late-successional and old-growth (LSOG) monitoring - Existing forest vegetation maps are complete for 10 of 12 physiographic provinces, with the remaining two to be finished in summer 2003. A recently developed approach for mapping canopy layering completes the data needed to map LSOG from tree size, percent canopy cover, and canopy structure.
- ◆ Northern spotted owls monitoring - The percentage of female owls nesting across the eight areas ranged from 48 to 83%, and the number of young fledged per area ranged from 16 to 98. The total of young fledged was 445, down 10% from the 2001 season.
- ◆ Marbled murrelets monitoring - The population of marbled murrelets living in the Plan's range was estimated to be 23,700, and the 95% confidence interval ranged from 18,400 to 28,900.
- ◆ Watershed condition monitoring - In 2002, 23 sixth field watersheds were sampled. Other efforts included an intensive quality- assessment and quality-control program, a large-scale watershed monitoring workshop, refinement of the data collection protocols, resolution of questions related to applying the monitoring plan, determining costs of fully implementing the program, and coordination with state agency personnel.
- ◆ Social and economic monitoring - During 2002, we completed a Phase II report focused on developing a monitoring option to identify causal links between federal forest management and economic and social change in forest-based communities. Phase III of the program was launched, which focuses on gathering and analyzing monitoring data for the 2004 report.
- ◆ Tribal - Eight Tribes from the Plan area were interviewed on the effectiveness of federal agency consultation in addressing treaty and other rights, access to and use of resources, and other interests.

Program Management	1-2
Monitoring Spotlight	3
Implementation	4-5
Late-Successional & Old-Growth	6-7
Northern Spotted Owl	8-9
MarbledMurrelet	10-11
Watershed Condition	12-13
Social & Economic	14
Tribal	15
The Budget	16
Interagency Monitoring Program Team	17-19
Reports	20-22

Program Management

Priorities

Management priorities for 2002 included staffing three lead positions, continuing to develop the social and economic module, implementing the tribal monitoring module, initiating a quality-assurance program, establishing a monitoring program website, and developing plan-effectiveness questions for the 2004 interpretive report.

Staffing

Lead positions were filled for the watershed, marbled murrelet, and social and economic effectiveness monitoring modules. The watershed position was filled by Steve Lanigan at the Forest Service. During 2002, the murrelet position was vacated when its occupant transferred; the US Fish and Wildlife Service filled the one vacated position with Mark Huff. The lead position for the social and economic module was filled by Susan Charnley of the Pacific

The tribal monitoring team has begun implementing their module using an interview process focusing on participation from tribal leaders and Federal land management line officers. In total, 76 tribes are to be interviewed by the close of 2004. Four tribal governments in Washington and Oregon were interviewed during the timeframe for this Annual Report, as were officials from four California tribes.

Quality Assurance

Efforts to develop a quality assurance management strategy progressed during 2002. Following guidelines for natural resources information established by the American National Standards Institute, a draft quality-assurance management plan (the quality plan) was produced by Craig Palmer.

With the watershed module serving as a pilot, each module will develop a quality-assurance plan that adheres to guidelines established in the quality plan. Fully implementing a quality-assurance strategy across all modules is expected by 2005.

Monitoring Website

The new monitoring website is posted at www.reo.gov/monitoring. The website provides access to various monitoring reports, publications, data, and tools. The Regional Ecosystem Office in Portland, and Bill Disbrow of the Forest Service, Rocky Mountain Region, provided support for developing and maintaining the website. During 2003, watch for expanded access to new data and analysis applications.

The 2004 Interpretive Report

The 2004 interpretive report will provide information critical to evaluating the success of the Northwest Forest Plan. During 2002, the Regional monitoring team devoted substantial effort to a plan for producing the 2004 interpretive report. Outlines, key tasks, schedules, and required resources were documented in work plans for each module. Two sets of questions on status and trends and on plan effectiveness were drafted and



Regional monitoring team members (L to R) Susan Charnley, Bruce Bingham, Mark Huff, Bruce Crespín, Dave Baker, Jon Martin, Craig Palmer, Melinda Moeur, Kirsten Gallo, Steve Lanigan. (Missing: Joe Lint, Roberto Morganti)

Northwest Research Station. The tribal monitoring module is being led by Bruce Crespín of the Bureau of Land Management, Oregon State Office.

Implementing the Modules

With a new module lead in place, the socio-economic team is poised to complete module design and implement socioeconomic monitoring on four pilot forests and in 12 forest-based communities in preparation for the 2004 interpretive report.

Program Management (cont.)



Northern spotted owl module leader, Joe Lint, maps out a monitoring strategy.

reviewed by program managers and scientists.

Although acquiring existing geospatial data for the 2004 report has progressed, improving coordination on identifying and developing interagency data is a high priority for 2003.

Information Resources

Acquiring or producing the large number of spatial data sources to meet federal interagency standards continues to pose a **major challenge** for the monitoring program.

Coordinating among agencies in producing seamless data layers, including vegetation, land-use allocations, watershed boundaries, streams, rivers and lakes, and so on continues, with many products scheduled to be completed by fall 2003. Some of the needed spatial data will not be available in time for the 2004 report.

Two important information applications are nearly complete. The first one is the

Vegetation Inventory and the Monitoring analysis tool (VIM). It functions through ArcGIS allowing users to characterize landscape-scale vegetation patterns incorporating Forest Service and Bureau of Land Management plot-scale data.

The monitoring program expects to use this application to generate plot-based estimates for the amount and characteristics of late-seral and old-growth vegetation and for northern spotted owl and marbled murrelet habitat. Version 1 is scheduled for release in early summer 2003.

The second application under development is a compliance monitoring database; it has a web interface and reporting tools. The Oracle application, designed for the Plan's implementation monitoring module, will be used to track our compliance with standards and guides provided under the record of decision. The data base could also support local compliance monitoring for National Forest and Bureau of Land Management planning. The application provides for administering of standards and guides, compliance questions, and annual monitoring participants.

A web-based component allows users to download questionnaires tailored to monitor projects for their units and to enter responses to a centralized data base. On the analysis end, the monitoring team can generate standard reports on compliance, adhoc summaries and graphs, and data for analysis with other applications. The first release is scheduled for mid-summer 2003.

Budget

The approved monitoring-program budget for 2002 was \$6.297 million (M): for implementation, \$263 thousand (K); northern spotted owl, \$2.553 M; vegetation, \$486 K; marbled murrelet, \$1.062 M; aquatic riparian, \$1.053 M; socioeconomic, \$200 K; biodiversity, \$58 K; tribal, \$40 K; and program management, \$582 K.

The budget chart (see page 16) shows the distribution of dollars by contributing agencies. The extreme 2002 fire season required budget adjustments to many programs. The monitoring program loaned \$300,000 to help offset the 2002 fire-season deficit, reducing the program management budget to \$282 K.

The budget request for 2003 was \$7.997 M, and the approved budget for 2003 (approved in March 2003) was \$6.286 M. Allocations for the implementation, late-successional and old growth, socioeconomic, and Tribal modules were slightly increased from 2002.

Monitoring Spotlight

The Vegetation Inventory and Monitoring Analysis Tool

How much old growth vegetation is present? Where is it? What does it look like? These basic questions can be addressed by applying the new computer application designed to summarize field data collected by US Forest Service and Bureau of Land Management vegetation inventory programs in the Pacific Northwest.

The Vegetation Inventory and Monitoring analysis tool (VIM) began in 2002 to meet the monitoring program's need to characterize late-seral and old-growth vegetation, northern spotted owl habitat, and marbled murrelet terrestrial habitat.

The prototype quickly demonstrated its capacity to support other programs as well, including the Survey and Manage Program, and National Forest and Bureau of Land Management planning efforts. Developing and supporting the VIM tool is now a joint effort of the Forest Service and the Bureau of Land Management.



Forest Inventory and Analysis (FIA) field crews collecting plot-based vegetation inventory data. Photo courtesy of PNW-FIA.

Developed in Visual Basic, the vegetation monitoring tool provides a query and reporting interface between plot-based vegetation inventory data and spatial data in ArcGIS. Current functioning allows the user to develop summaries driven by user-defined query parameters for area extent, vegetation, and site characteristics.

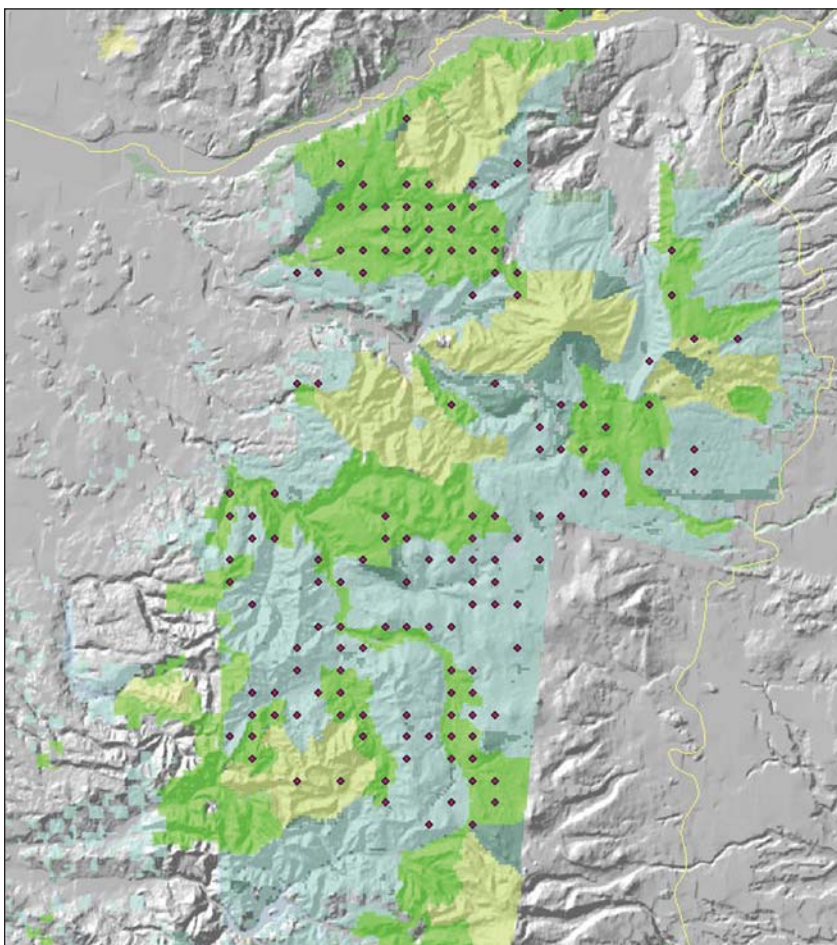
Running the model finds field plots that meet specific criteria. These plots then provide the data for further analysis, including summary statistics for a variety of structural attributes associated with live trees, snags, and down wood, and estimates of acreage bounded by boot-strapped confidence intervals.

When intersected with any number of geospatial data sources -- such as terrain, ownership, or land-use categories, ArcGIS allows the user to visualize the spatial distribution of samples contributing to the estimates.

Beta testing is scheduled for May 2003. A first release is expected by early summer; it will include a version that can be used outside of ArcGIS. Through the next year, more vegetation attributes will be added for designing queries.

Contact Information

Bruce Bingham, Assistant Monitoring Program Manager
USDA Forest Service, 333 SW First Ave.,
Portland, OR 97204-3440
Phone: 503-808-2251
Email: bbingham@fs.fed.us



Example of inventory plots meeting query criteria, intersected with map coverage of a National Forest in northern Oregon. Land use categories implemented by the Northwest Forest Plan are represented by colored polygons; bright green is late seral reserve, yellow is congressionally withdrawn, and blue green is matrix.

Implementation

The 2002 field season marked the seventh year of the Plan's implementation monitoring program designed to determine and document whether the record of decision and its corresponding standards and guidelines are being consistently followed across the Plan's range.



Photo by Dave Baker

Road decommissioning in the California Coast Province.

The fiscal year 2002 program was designed to sample 24 (two per province) randomly selected density management projects in late-successional reserves and 12 other projects (one per province). Other projects are undersampled activities and programs such as prescribed fire, grazing, recreation, and watershed restoration.

The 5th-field watersheds containing the projects were also to be monitored. Two density management project reviews were omitted, however; one review was cancelled because of the severe 2002 fire season, and one province had only one density management project to review.

In addition, one province combined two thinnings and a prescribed fire project into one review and reported the results on a single project questionnaire. Therefore, this summary was developed from 21 watershed reports, 21 late-seral density management project reports, and 11 "other" project reports.

Highlights

As in previous years, the results from both the watershed-scale monitoring and the project reviews indicate high compliance with the standards and guidelines. Highlights include the following:

- ◆ Watershed analyses were completed for 19 of the 21 watersheds, and two of these analyses had been updated;
- ◆ Riparian reserve widths had been modified at the project scale in four watersheds, and environmental analyses were used to document the modified widths;
- ◆ Road mileages were reduced; since 1994, 7% in 10 key watersheds and 5% in 13 fifth-field watersheds;
- ◆ Assessments were completed for all 21 of the late-successional reserves in the sampled watersheds;
- ◆ Project review results showed general compliance of 98% with standards and guidelines. The compliance of the 32 projects reviewed ranged from 75 to 100% with 22 projects 100 % compliant;
- ◆ The most common activities in late-successional reserves were maintaining roads, improving habitat, suppressing and preventing fire, enhancing recreation, collecting special forest products, issuing special use permits, and treating non-native species;
- ◆ Most activities (79%) were deemed neutral or beneficial in meeting late-successional reserve objectives. Several pre1994 activities (developments and rights-of-way) and existing recreation activities were considered to not meet objectives and to have some level of negative impacts. The impacts of other activities (mining and fire suppression / prevention) were described as unknown;
- ◆ Adverse biological effects associated with instances of non-compliance appeared to be minimal at the regional scale. Where noncompliance occurred, the local effects were judged to be generally low to moderate.



Photo by Dave Baker

LSR density management project in the east Washington Cascades Province.

Looking Ahead

Although room for improvement is possible, none of the deficiencies noted in this report warrant recommending major corrective actions or operational shifts by land management agencies. Participation of the REO-LSR working group greatly enhanced the reviews.

Local Forest Service and Bureau of Land Management units are aware of specific, local noncompliance findings, and they are expected to take corrective action. Several have already done so.

Several actions called for in the record of decision have not happened yet, including evaluating existing recreation facilities in riparian reserves for compliance with aquatic conservation strategy objectives and adjusting riparian reserve boundaries to fit local conditions.

Generally, participation increased in the field reviews, but, in a few watershed reviews, participation by members of the Provincial Advisory Committee declined from previous years. Field-unit managers continue to acknowledge the value of this public review in helping to build understanding and trust.

The focus for the FY03 program will be the monitoring of density management projects in the late-successional reserves, the development of the data base tool, and the preparation of the 2004 Interpretive Report.

Contact Information

Dave Baker, Implementation Monitoring Module Leader
Bureau of Land Management
777 NW Garden Valley Blvd, Roseburg, OR 97470
Phone: 541-464-3223; Email: d1baker@or.blm.gov
Website: www.reo.gov/monitoring/implementation

Compliance by individual categories identified in the project review questionnaire for 2002.

Questionnaire Categories	Number of Responses			Percent Compliance**
	Met	Not Met	Not Capable*	
All land-use allocations	135	1	1	99
Late-successional reserves and managed late-successional areas	275	7	18	97
Watershed analysis and aquatic conservation strategy and riparian reserves	344	6		99
Matrix				N/A
Adaptive management areas	4			100
Research	12			100
Species	67	1	15	99
Other project questions	28	2		93
Total of the 32 projects reviewed	865	17	34	98



Late-successional reserve density management project in the Olympic Province.

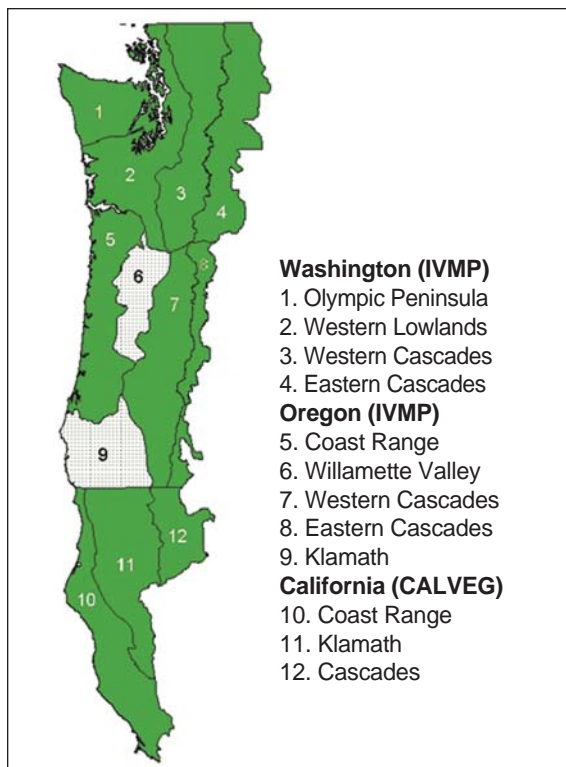


Late-successional reserve (LSR) area in the Yakima Province. Ken Denton "stumping" for LSR management.

* Not Capable: Physical site limitations prohibit true compliance or meeting the Standard and Guideline (e.g., no existing snags or lack of sufficient material for coarse woody debris).

** Percent Compliance = (number Met + number Not Capable) / (number Met + number Not Capable + number Not Met) x 100%. Responses of Met, and Not Capable were considered to have met the compliance criteria (from a biological perspective) associated with Record of Decision Standards and Guidelines.

Late-Successional & Old-Growth



Completion status of existing vegetation maps by physiographic province for the Interagency Vegetation Mapping Project (IVMP). Only provinces 6 and 9 remain incomplete.



Complex canopy layering and large snags characteristic of old-growth forests.



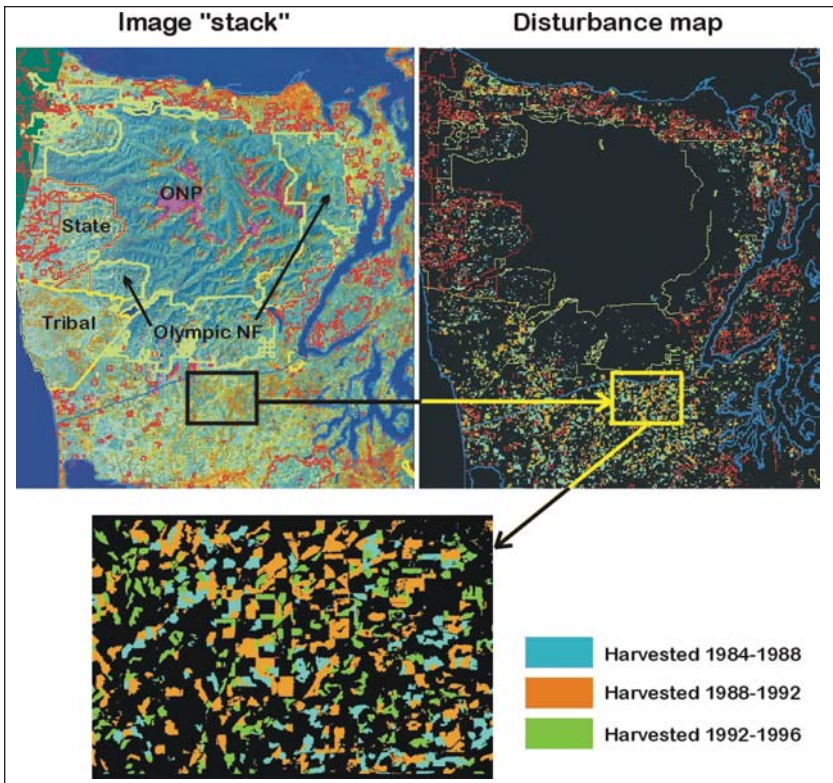
The purpose of the late-successional and old-growth (LSOG) monitoring module is to assess the status and trends of forest vegetation to determine if the Plan will achieve the planned goals and objectives for maintaining and restoring these forests.

The primary elements of LSOG effectiveness monitoring are estimates of forest baseline conditions and periodic assessment of changes from the baseline. Major components of the monitoring module are mapping the existing vegetation by remote sensing, estimating amounts and characteristics of these forests from statistical analysis of inventory data, and estimating change through remote sensing and repeated measurement of permanent inventory plots.

Highlights

Significant progress was made in developing and assembling the monitoring information needed to complete the first 10-year evaluation of the effects of the Plan on LSOG vegetation:

- ◆ Existing vegetation maps are complete for 3 of 3 provinces in California under the California Vegetation Mapping Program (CALVEG) for 4 of 4 physiographic provinces in Washington, and for 3 of 5 provinces in Oregon, under the Interagency Vegetation Mapping Project (IVMP). Remaining province maps in Oregon (Klamath and Willamette Valley) are scheduled for completion by July 2003.
- ◆ A new approach for modeling number of canopy layers has been tested and found to produce reliable results. The model uses an index of vertical structural diversity developed by researchers at the Pacific Northwest Research Station (Cohen and Spies 1992) that shows predictable association with Landsat satellite signatures. The result will be a map of canopy structure for predicting simple (single-layered) versus complex (multiple-layered) forest canopies.
- ◆ Creation of vegetation classes from existing vegetation map layers of tree size, forest cover, and canopy structure, is being piloted in two study areas in Oregon, and in one physiographic province in California. The results of the pilot will be used to determine the best approach for Plan-wide analysis of late-successional and old-growth.
- ◆ Change-detection cycles have been completed for California provinces through 1996 for northeastern California and 1998 for the north coast. For Washington and Oregon, mapping of stand-replacing disturbances is complete for western Washington and for western and eastern Oregon between 1984 and 2002. Eastern Washington disturbance maps will be completed and the project finished by September 2003.
- ◆ Major progress was made in compiling data and methods for assessing conditions with statistical reliability from grid-plot inventory data, including developing a vegetation and inventory monitoring tool (see Monitoring Spotlight on page 3) and a data base for integrating inventory data from various owners and sample designs in a common format across the PNW-FIA Integrated Database).



Preliminary results from Pacific Northwest Research Station remote sensing change detection project in the area surrounding Olympic National Park. Stand-replacing disturbances between 1984 and 1996 are shown on private lands, state lands (red outline), Tribal lands - yellow outline, Olympic National Forest - green outline.



Bridge and trail in an old growth forest

Looking Ahead

All current work within this module is directed at progressing toward completing the first 10-year comprehensive evaluation of Plan effectiveness, which will be published in 2004. All developing and assembling of monitoring data will be completed in September 2003. Full-scale analysis will begin in September using completed vegetation maps and analytical approaches discussed in the 2001 annual summary and in study plans on file.



Old-Growth Douglas-fir

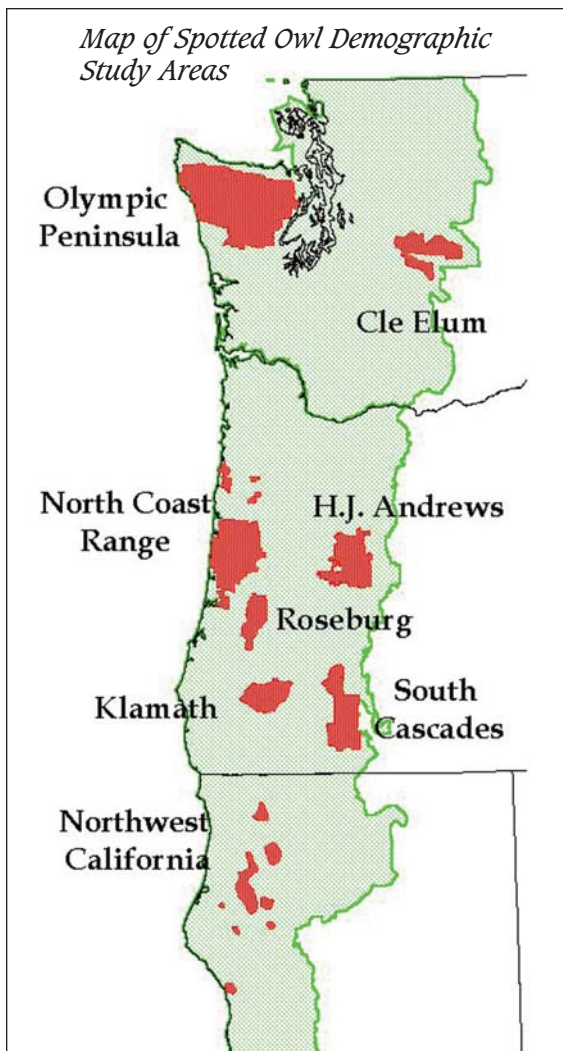
Contact Information

Melinda Moeur, Late-Successional and Old-Growth Monitoring Module Leader
 USDA Forest Service, 333 SW First Ave.,
 Portland, OR 97204-3440
 Phone: 503-808-2811
 Email: mmoeur@fs.fed.us
 Website: www.reo.gov/monitoring/og

Northern Spotted Owl



Fledgling spotted owl perched next to large, broken-topped nest tree.



"Mousing" owls helps biologists find nest trees.

The ninth consecutive year of monitoring populations of the northern spotted owl (*Strix occidentalis caurina*) under the Plan ended in 2002. Monitoring results will provide information on the Plan's success in arresting the downward trend in spotted owl populations and in maintaining and restoring habitat conditions on federally administered forest lands throughout the owl's range.

The primary objectives of the monitoring plan are to:

- ◆ Assess changes in population trend and demographic performance of spotted owls on federally administered forest lands in the owl's range.
- ◆ Assess changes in the amount and distribution of nesting, roosting, and foraging habitat, and dispersal habitat for spotted owls on federally administered forest lands.

Integrating data from population and habitat monitoring is being explored through research to develop models to predict owl population status from the state of the habitat.

Highlights

The following monitoring results are among the highlights of the 2002 monitoring effort.

- ◆ More than 1100 sites, in eight demographic study areas, were surveyed to gather information on owl occupancy, survival, and reproduction. Spotted owl pairs were present at 52% of these sites, and 445 young were fledged. Pair occupancy was unchanged from 2001, and the number of young fledged was down from the 492 counted in 2001.
- ◆ Across the eight areas, the percentage of female owls that nested ranged from 48.1% to 83.0%, and the number of young fledged per area ranged from 16 to 98.
- ◆ In 2002, 95% of the fledgling owls were banded and released for future observation. A female owl banded as a juvenile in Klamath study area in 1998 was recaptured 74 miles to the east of the



Photo by Frank Oliver



original banding site. The maximum distance from a band recovery of a spotted owl reported by Forsman in his recent dispersal monograph was 69 miles. (Forsman et al., 2002a).

- ◆ In the Cle Elum study area in Washington, the number of occupied territories declined by about 60% from 1992 to present, though the causes are unknown.
- ◆ A draft spotted owl habitat map was produced for the Western Cascades Province in Oregon. An innovative method used owl activity centers as reference polygons to translate the attributes of the vegetation map into owl habitat attributes.
- ◆ Modeling demographic rates related to vegetative characteristics on study areas of the Roseburg BLM, H.J. Andrews Experimental Forest, and Medford BLM was completed. Initial work was begun on models to predict occupancy.

Summary of northern spotted owl occupancy and reproduction by demography area for 2002; these data are preliminary; values may change in the final analysis

Demographic area	Sites surveyed (number)	Sites with a territorial pair (number) (%)	Females nesting (%)	Young fledged (number)
Olympic Peninsula	135	67 49.6	83.0	71
Cle Elum	66	18 27.3	58.8	16
H.J. Andrews	161	87 54.0	62.0	60
North coast	204	88 43.1	48.1	31
Roseburg	140	80 57.1	57.7	51
South Cascades Range	162	83 51.2	79.0	98
Klamath	150	97 64.7	65.6	83
Northwestern California	93	58 62.4	48.3	35
TOTALS	1111	578 52.0		445

Looking Ahead

In 2003, another year of demographic data will be gathered, and habitat maps for all physiographic provinces will be completed. The population and habitat teams will be focusing on data summary and analysis, in preparation for the 2004 interpretive report. The workshop to analyze the population data has been scheduled for January 2004. The primary focus of the model research team will be developing models to predict occupancy.

Contact Information

Joe Lint, Northern Spotted Owl Monitoring Module Leader
Bureau of Land Management,
777 Garden Valley Blvd., Roseburg, OR 97470
Phone: 541-464-3288; Email: joseph_lint@or.blm.gov
Website: www.reo.gov/monitoring/nso



Adult spotted owl with color band (blue) on the left leg and an aluminum, numbered band on the right leg. The color band permits identification of individual owls without recapture.



Biologist in search of spotted owls in southern Oregon.

Marbled Murrelet



*Marbled Murrelet, *Brachyramphus marmoratus*, is a secretive nester and highly selective about nest sites, using large branches of old-growth trees as a nest platform. The first nest was discovered only 29 years ago.*



Although murrelets breed in older forests, they are found most often at sea where they feed.

The purpose of the effectiveness monitoring program for marbled murrelet (*Brachyramphus marmoratus*) is to assess population trends and to determine the characteristics and trends of suitable habitat in the Plan area. Information gathered for this assessment is used to maintain and restore marbled murrelet habitat and populations on federal lands. Marbled murrelet was listed as a threatened species by the U.S. Fish and Wildlife Service in 1992 in Washington, Oregon, and California, and a recovery plan was developed in 1997.

Marbled murrelets are difficult to monitor in their nesting habitat. They typically nest in tall trees found in old forests, and they are very secretive. Few nests have been found.

Marbled murrelets feed while at sea, and only use forested environments to rear young. Hence, the most cost-efficient and effective way to monitor marbled murrelet populations is at sea where they can be readily counted. At-sea counts, however, are independent of habitat used for breeding, and linking counts to land-based habitat descriptions is difficult.

An approach for marbled murrelet effectiveness monitoring was developed in 1999: it proposed long-term monitoring of at-sea populations and developing models of nesting habitat. At-sea populations are surveyed under a unified sample design spanning the coast lines of the three states where the species is listed. The unified surveys are used across five conservation zones that overlap the Plan (see figure).

Marbled murrelets are counted by two observers on either side of boats navigated to follow transect lines predetermined by a randomized sampling procedure. Transect survey counts and distances to birds are analyzed to estimate the population and density of birds in the Plan area.

Models to estimate the amount and distribution of suitable habitat for marbled murrelets are being developed by using vegetation measurements taken at random sites and sites with nesting activity, and information derived from aerial photographs and satellite imagery of nest-activity sites. These models will be used to detect potential change in murrelet habitat over time in the Plan area and to guide future conservation of the species.

Highlights

Highlights of the effectiveness monitoring program for marbled murrelets include the following:

- ◆ The third season of at-sea population monitoring was completed mid-May through July 2002, using the unified design developed for the effectiveness-monitoring program. The 2002 population estimates are shown in the table opposite.
- ◆ Marbled murrelet density was highest in Zone 4, the southern Oregon and northern California coast, and the lowest in Zone 5, the California coast from the San Francisco Bay north through Mendocino County.



Marbled Murrelet Conservation Zones



◆ The largest number of marbled murrelets was in Zone 1, Puget Sound area, and the smallest in Zone 5.

◆ Vegetation measurements have been completed at 77 of 80 selected known sites of nesting activity and at 80 of the randomly selected comparison sites.

Looking Ahead

Statistically valid population trend estimates are likely after about 8 to 10 years of annual monitoring surveys (survey years 2007 to 2009). Until valid trends can be projected, population estimates should be viewed as preliminary.

Completed population surveys are expected in the five conservation zones for the 2003 breeding season. Early forecasts of funding available to complete surveys in 2004 for all five

conservation zones fall short by about 35%. Projected costs for the 2003 field surveys across all zones are about \$550,000.

Models based on vegetation and landscape-scale parameters to predict suitable habitat for marbled murrelets in the area of the Plan will be developed and assessed in 2003.



Marbled murrelets at sea.

Contact Information:

Mark Huff, Marbled Murrelet Monitoring Module Lead, U.S. Fish and Wildlife Service, 911 NE 11th Avenue, Portland, OR 97232
Phone: 503-231-2042
Email: mark_huff@r1.fws.gov
Website: www.reo.gov/monitoring/murrelet



Photo by Martin Raphael

Population surveys for marbled murrelets are done at sea during the breeding season from mid-May through July.

Summary of marbled murrelet population estimates for the 2002 breeding season across all five conservation zones in the Plan area

Variable	Estimate
Area sampled (km ²)	8,811
Population estimate	23,700
95% confidence interval for population	18,400-28,900
Density (birds/km ²)	2.69
Coefficient of variation of density (%)	11.4

Watershed Condition



A laser rangefinder was used to measure stream channel profile.



Stream substrate was measured during "pebble counts."

The purpose of the watershed condition monitoring module (also known as aquatic riparian effectiveness monitoring program or AREMP) is to assess the ecological condition of watersheds by evaluating the status and trends in watershed, stream, and riparian conditions.

Specific objectives are to assess aquatic, riparian, and upslope ecosystems; develop ecosystem management decision support models to refine indicator interpretation; develop predictive models to improve the use of monitoring data; provide information for adaptive management by analyzing trends in watershed condition and identifying elements that result in poor watershed condition; and provide a framework for adaptive monitoring at the regional scale.

We sampled 23 watersheds at the sixth-field scale in 2002 in our first year of monitoring. Our goal to sample 50 watersheds was not met because of insufficient funds. We implemented a quality-assessment and quality-control program, convened a large-scale watershed monitoring workshop, continued the refinement of data-collection protocols, and resolved questions related to implementing the monitoring plan. Full implementation program costs were refined, and meetings with state agency personnel to discuss how to coordinate monitoring efforts continued.

Highlights

Highlights of the watershed condition monitoring module include the following:

- ◆ During the 2002 field season, 41 sites in 23 watersheds (33% of the total sites surveyed) were resurveyed ("blind checks") as part of our quality assessment program. Results of these re-surveys indicated protocols and techniques that need improvement. The quality program also revealed potential limitations in some types of field equipment.
- ◆ We added the following components of the program: personnel exit surveys, and round-table discussions with crew members about training, the protocols, and the execution of the summer field season. Results of personnel exit surveys and crew comments are being incorporated into the 2003 field-season training and field protocol.
- ◆ Watershed condition module personnel participated in a comparison of several state and federal stream survey and monitoring programs to determine which protocols most precisely measure each physical stream attribute. Results will be reported in 2003.
- ◆ The staff sponsored a large-scale watershed monitoring workshop in November to share information about current monitoring programs. Action teams were created to recommend a core set of attributes and associated protocols for assessing in-channel and biological attributes.
- ◆ Glade Creek watershed, which burned after the 2001 sampling season, was resampled to determine if our sampling methods would



We looked for aquatic and terrestrial amphibians at each sampling site.

be adequate to detect changes. We were able to detect changes in habitat characteristics and also found that fish size and their spatial distribution had changed.

◆ Monitoring-plan personnel continued hosting monthly meetings with state agency representatives from Washington, Oregon, and California to explore how to develop a monitoring partnership. We completed an overview of attributes and associated protocols for 10 different

state and federal monitoring programs. We also started to explore how these partnership efforts could be used by the federal caucus to meet their state and tribal coordination needs.

◆ The anticipated costs for fully implementing the monitoring plan, based on sampling an average of 6 sites for each of the 50 watersheds sampled each year, is about \$5,917 for each sample site. This amount is slightly higher than past estimates, mostly because of increased vehicle costs.

Looking Ahead

A series of workshops will be held in spring and summer 2003 to bring together experts from each of the Plan's eight aquatic provinces to help refine evaluation criteria for each attribute used in the decision-support model. They will also peer-review the decision-support model structure.

Statisticians from the Environmental Protection Agency are working with us to determine the best strategy for detecting status and trend of watershed condition, given current funding.

Contact Information

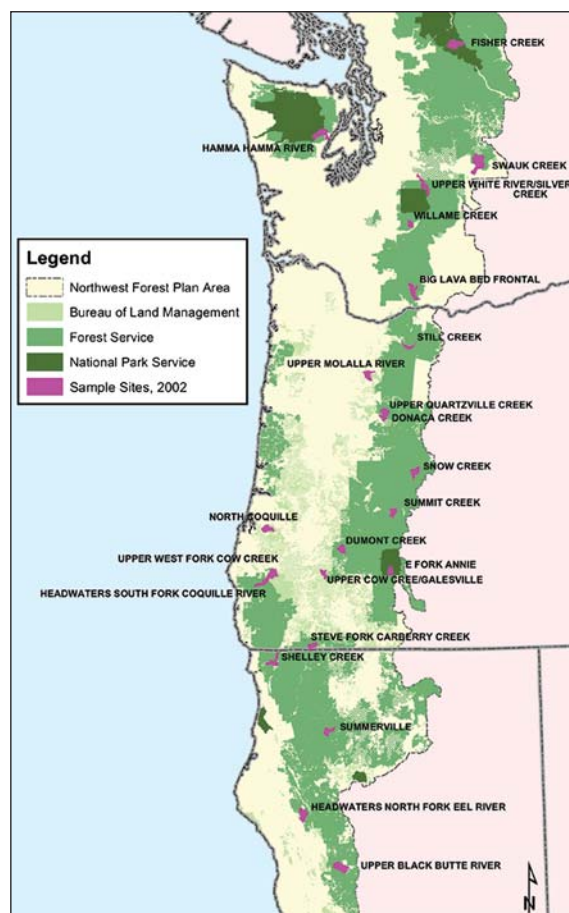
Steve Lanigan, Watershed Condition Monitoring Module Leader
 USDA Forest Service, 333 SW First Ave.,
 Portland, OR 97204-3440
 Phone: 503-808-2261
 Email: slanigan@fs.fed.us
 Website: www.reo.gov/monitoring/watershed

Location of the twenty-three sixth-field watersheds sampled during 2002.



Photo by Steve Lanigan

Stream substrate was also measured using a "sediment grid."



Social & Economic



A monitoring question for this module is whether or not predictable levels of timber and non-timber resources are available and being produced.

The purpose of the social and economic monitoring module is to assess whether the social and economic goals of the Northwest Forest Plan are being met. During 2002 the module continued developing and refining their monitoring strategy.

Developing the monitoring program has progressed as a multi-stage process. From 1999 through mid-2002, Phases I and II were completed in cooperation with the University of Washington. In late 2002, Phase III of the program was initiated.

The Phase I report (Sommers 2001) reviews available information and recommends developing a community-scale model and data collection strategy. Phase II (Sommers et al. 2002, Jackson et al. 2002) focuses on developing a monitoring option capable of identifying causal links between federal forest management and local economic and social change.

Peer review during Phase II noted a need to obtain additional or other data types to productively describe the social and economic

effectiveness of the Plan. Accordingly, beginning early in 2002, the team explored additional options for:

- ◆ Delineating and describing small, local communities across the entire planning area (Donoghue and Haynes 2002, Donoghue 2003)
- ◆ Using mixed-methods case studies to adequately describe complex socioeconomic changes and interactions in sample local communities
- ◆ Monitoring forest actions (for example, contracting, hiring, and grant disbursement) with potential to affect local communities more than traditionally measured forest outputs (Moseley and Wilson 2002).

Phase III began with continued development and refinement of the monitoring strategy. Phases I and II focused on answering the ROD evaluation question: Are local communities and economies experiencing positive or negative changes that may be associated with federal forest management? Phase III of the module expands its scope by including an additional evaluation question from the ROD: Are predictable levels of timber and non-timber resources available and being produced?

Expanded outreach initiated during the year sought feedback on socioeconomic information needs from Provincial Advisory Committees, and regional and unit-level planners and line officers from the Forest Service and BLM. The Monitoring Team also continued close coordination with Regional Ecosystem Office (REO) executives and managers throughout 2002.

Planned work during 2003 includes:

- Continued outreach to National Forest System and BLM unit managers and Provincial Advisory Committees (PACs).
- Updating Northwest Forest Plan community delineations to make it possible to assess trends in key social and economic indicators from the U.S. decennial Census and characterize changing social and economic conditions in the Plan area communities.
- Finalizing data collection and analysis methods and protocols.
- Collecting and analyzing monitoring data available from existing databases.
- Piloting forest and community level socioeconomic monitoring by doing fieldwork on four case study forests and in 12 communities.

Contact Information

Susan Charnley, Social and Economic Monitoring Module Leader
USDA Forest Service, 333 SW First Ave.,
Portland, OR 97204-3440
Phone: 503-808-2051; Email: scharnley@fs.fed.us
Claudia Stuart, Module Coordinator, Email: cstuart@fs.fed.us
Website: www.reo.gov/monitoring/socio

Tribal

Seventy-six American Indian tribal governments have rights and interests in the area covered by the Plan in portions of northwestern California, western Oregon, and western Washington.

Federal agencies, such as the Forest Service and the Bureau of Land Management, consult with tribal governments on a government-to-government basis to ensure that these rights (such as treaty and nontreaty fishing and water rights) and interests (such as general access to culturally important resources) are considered in agency decisions. Furthermore, the record of decision for the Plan committed to monitoring effects on tribal rights, interests, and access to and use of federal lands and resources.

Purpose

The purpose of the tribal monitoring module is to review the commitments in the record of decision and determine the effectiveness of federal agency consultation with tribal governments in addressing treaty and other rights, access to and use of resources, and other interests.

Highlights

Thus far, eight Tribes, throughout the area of the Plan, accepted our invitation to meet with them and provide their responses to our monitoring questions:

- Bear River Band of the Rohnerville Rancheria (CA)
- Blue Lake Rancheria (CA)
- Confederated Tribes of the Grand Ronde Community of Oregon
- Coquille Indian Tribes (OR)

- Karuk Tribe of California
- Lower Elwha Tribal Community (WA)
- Quinault Indian Nation (WA)
- Round Valley Indian Tribes (CA)

American Indian tribal governments were generally very receptive to monitoring and most indicated that communications were improving. Several Tribes made recommendations for enhancing effective government-to-government relations.

Looking Ahead

The Tribal Monitoring Module will interview 30 additional tribes by the end of 2003, with another 38 tribal monitoring meetings planned for 2004. A tribal monitoring advisory group will be reconvened as a subgroup of the Interagency Advisory Committee (IAC), to provide tribal views on Plan implementation and related activities, particularly for the Tribal Monitoring Module. The module is being refined to reflect lessons learned through the initial eight interviews with tribal governments.

Contact Information

Bruce Crespin, Tribal Monitoring Module Coordinator
BLM Oregon State Office
Phone: 503-808-6493
Email: bcrespin@or.blm.gov
Website: www.reo.gov/monitoring/tribal



Pacific Northwest Indian cedar bark basket containing bitterroot and dried biscuitroots.

Cedar stakes and firewood for baking salmon.

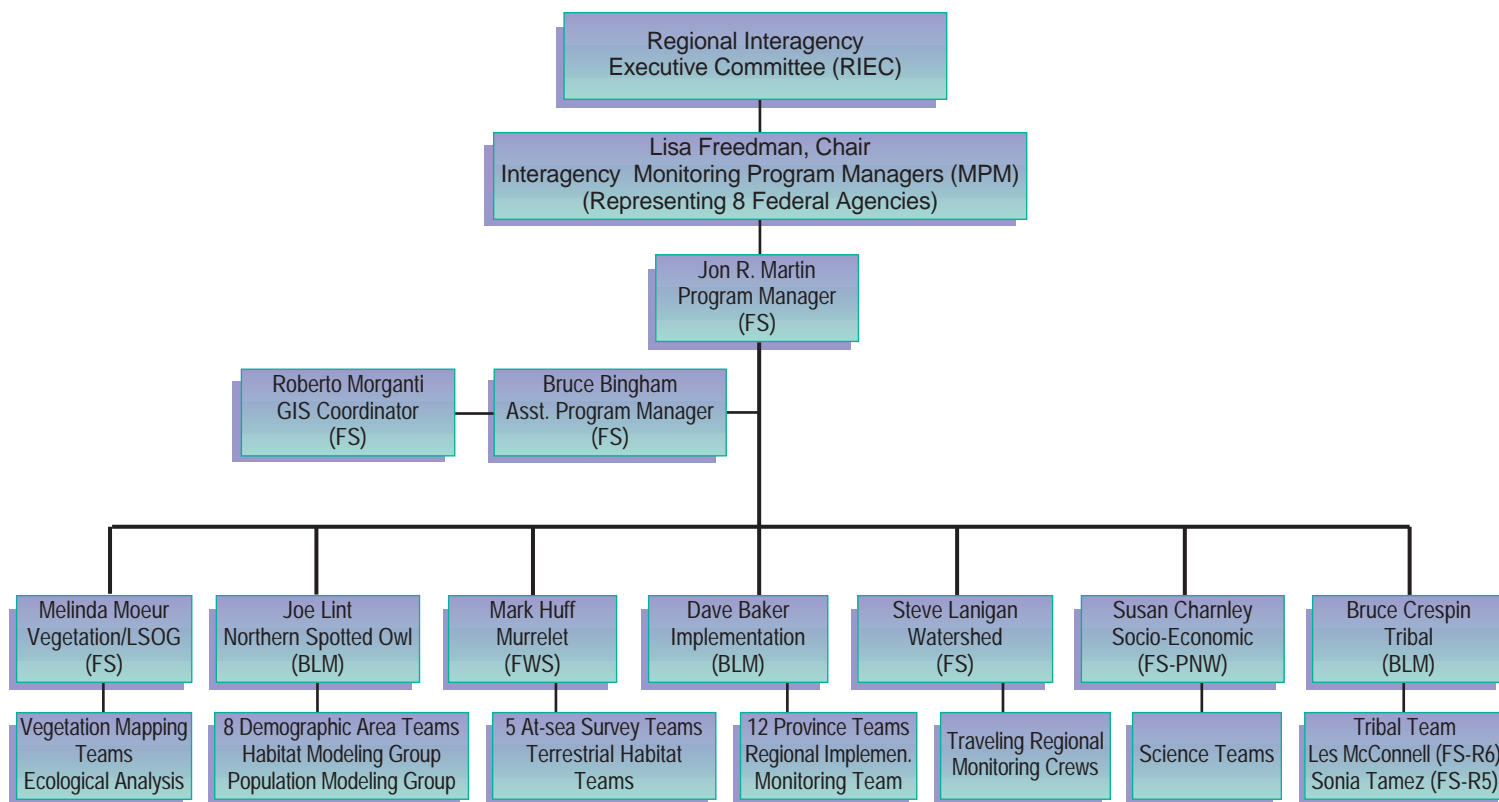


Photo by Les McConnell

Budget - NWFP Interagency Monitoring Program

NWFP Monitoring - Priorities		Needs	Contributions										
			BLM	R-5	R-6	NPS	FWS	PNW	PSW	USGS	EPA	NMFS	Total
Program	Manager	120			120								120
	Info Mgr & GIS	177			177								177
	Contracts, 04 Rpt	285	73	65	147								285
	TOTAL	582	73	65	444	0	0	0	0	0	0	0	582
Implementation	Lead	110	110										110
	Regional IMT	130	40	30	30		30						130
	Info/Database	23			23								23
	MODULE TOTAL	263	150	30	53	0	30	0	0	0	0	0	263
NSO	Lead	60	60										60
	Demography	2197	613	299	993	190		102					2197
	Models/Maps	296			11		10	142		133			296
	MODULE TOTAL	2553	673	299	1004	190	10	244	0	133	0	0	2553
LSOG-VEG	Lead	120			120								120
	Remote Sensing	97		25	72								97
	Veg. Change PNW	68		30	38								68
	IVMP contr., misc.	91	91										91
	FIA Add-ons – R5	110		110									110
	MODULE TOTAL	486	91	165	230	0	0	0	0	0	0	0	486
MaMu	Lead	110					105			5			110
	Population	524					251	88	110				449
	Habitat modeling	178					15	73	90				178
	Vegetation Plots	250	120		25			105					250
	MODULE TOTAL	1062	120	0	25	0	371	266	200	5	0	0	987
Watershed	Lead	93			93								93
	Ops & GIS 4FTE	248	133	49	66								248
	DSM Development	155						89		66			155
	Wtrshed Sampling	557		127	170						90	170	557
	MODULE TOTAL	1053	133	176	329	0	0	89	0	66	90	170	1053
Socio-econ	Coordinator, Misc	55		50	5								55
	Community Pilot	145		45	100								145
	MODULE TOTAL	200	0	95	105	0	0	0	0	0	0	0	200
Biodiversity	Plan	58						31		27			58
	MODULE TOTAL	58	0	0	0	0	0	31	0	27	0	0	58
Tribal	Analysis, rpt, misc	10			10								10
	Tribal Liaisons	30	9	9	12								30
	MODULE TOTAL	40	9	9	22	0	0	0	0	0	0	0	40
Totals		6297	1249	839	2212	190	411	630	200	231	90	170	6222
% contributed fy02			19.8	13.3	35.1	3.0	6.5	10.0	3.2	3.7	1.4	2.7	100.0

Interagency Monitoring Program Team



2002 Interagency Regional Monitoring Program Team Participants

Interagency Monitoring-Program Managers (MPM)

Lisa Freedman (Chair)	USFS-R6	lfreedman@fs.fed.us
Dave Busch	USGS	dbusch@or.blm.gov
Becky Gravenmier	PNW	bgravenmier@fs.fed.us
Barry Mulder	USFWS	barry_mulder@r1.fws.gov
George Lottritz	USFS-R5	glottritz@fs.fed.us
Garland Mason	PSW	gmason@fs.fed.us
Ken Mabery	NPS	Ken_Mabery@nps.gov
Neal Middlebrook	BLM	nmiddlebrook@or.blm.gov
Steve Morris	NMFS	Steve.Morris@noaa.gov
Dave Powers	EPA	powers.david@epa.gov

Interagency Regional Monitoring Team (RMT)

Jon Martin, manager	USFS-R6	jrmartin@fs.fed.us	503-808-2269
Dave Baker, implementation	BLM	d1baker@or.blm.gov	541-464-3223
Bruce Bingham, asst. program manager	USFS-R6	bbingham@fs.fed.us	503-808-2251
Susan Charnley, socio-economic	PNW	scharnley@fs.fed.us	503-808-2051
Bruce Crespin, tribal	BLM	bcrespin@or.blm.gov	503-808-6493
Mark Huff, marbled murrelets	USFWS	mark_huff@r1.fws.gov	503-231-2042
Steve Lanigan, watershed	USFS-R6	slanigan@fs.fed.us	503-808-2261
Joe Lint, northern spotted owls	BLM	jlint@or.blm.gov	541-464-3288
Melinda Moeur, vegetation	USFS-R6	mmoeur@fs.fed.us	503-808-2811
Craig Palmer, reporting	UNLV	palmerc@unlv.edu	702-895-1797

Interagency Monitoring Program Team

Implementation Monitoring Module

Dave Baker - Module Leader, BLM, Roseburg, OR

Regional Implementation Monitoring Team

Gery Ferguson, Deschutes National Forest, OR
Liang Hsin, BLM, Portland, OR
Mario Mamone, USFWS, Portland, OR

Provincial Implementation Monitoring Team Leaders

Neal Forrester, Willamette National Forest, OR
Dave Fuller, BLM, Arcata, CA
Bob Gunther, BLM, Coos Bay, OR
Ward Hoffman, Olympic National Forest, WA
Paul Jeske, BLM, Salem, OR
Lynda Karns, Klamath National Forest, CA
Jodi Leingang, Wenatchee National Forest, WA
Bill Ramos, Mt-Baker National Forest, WA
John Roland, Gifford Pinchot National Forest, WA
Belle Smith, BLM, Salem, OR
Mike Vandame, Mendocino National Forest, CA

Late-Successional Reserve Work Group

Grant Gunderson, USFS-R6, Portland, OR
Ken Denton, USFS-R6, Portland, OR
Shawne Mohoric, USFS-R6, Portland, OR

Late-Successional and Old-growth Effectiveness Monitoring Module

Melinda Moeur - Module Leader, USFS R6, Portland OR

Old-growth Scientific/Management Team

Tom DeMeo, USFS R6, Portland OR
Miles Hemstrom, USFS PNW, Portland, OR
Tom Spies, USFS PNW, Corvallis, OR
Ralph Warbington, USFS R5, Sacramento, CA

Change Detection Team

Warren Cohen, USFS PNW, Corvallis, OR
Sean Healey, USFS PNW, Corvallis, OR
Lisa Levien, USFS R5, Sacramento, CA

Inventory Data Team

Jim Alegria, USFS R6, and BLM, Portland, OR
Kevin Casey, USFS R5, Sacramento, CA
Andy Gray, USFS PNW, Portland, OR
Karen Waddell, USFS PNW, Portland, OR
Ralph Warbington, USFS R5, Sacramento, CA

Interagency Vegetation Mapping Project Team

Jim Alegria, BLM, Portland, OR
Julie Browning, Titan Systems Corporation, Portland, OR
Warren Cohen, USFS PNW, Corvallis, OR
Tom DeMeo, USFS R6, Portland OR
Craig Ducey, Titan Systems Corporation, Portland, OR
Karin Fassnacht, USFS R6, Corvallis, OR
Chris Grob, Titan Systems Corporation, Portland, OR
KC Kroll, Titan Systems Corporation, Portland, OR
Melinda Moeur, USFS R6, Portland OR
Jeff Nighbert, BLM, Portland, OR
Tom Spies, USFS PNW, Corvallis, OR
Dale Weyermann, USFS PNW, Portland, OR

CALVEG Team

Hazel Gordon, USFS R5, Sacramento, CA
Brian Schwind, USFS R5, Sacramento, CA
Ralph Warbington, USFS R5, Sacramento, CA

Northern Spotted Owl Effectiveness Monitoring Module

Joe Lint - Module Leader, BLM, Roseburg, OR

Population Monitoring

Steve Ackers, Oregon State Univ., Corvallis, OR
Steve Andrews, Oregon State Univ., Corvallis, OR
Robert Anthony, USGS, Corvallis
Eric Forsman, PNW, Corvallis, OR
Alan Franklin, USGS, Fort Collins, CO
Scott Gremel, Olympic National Park, WA
Rocky Gutierrez, University of Minnesota
Patti Happe, Olympic National Park, WA
Rob Horn, BLM, Roseburg, OR
Chris Larson, BLM, Medford, OR
Pete Loschl, Oregon State Univ., Corvallis, OR
Frank Oliver, BLM, Roseburg, OR
David Pavlacky, University of Minnesota
Janice Reid, PNW, Roseburg, OR
Stan Sovern, Oregon State Univ., Cle Elum, WA

Habitat Map Development and Habitat Monitoring

Ray Davis, Umpqua National Forest, OR
Joseph Lint, BLM, Roseburg, OR
Barry Mulder, USFWS, Portland, OR
Martin Raphael, PNW, Olympia, WA
Lynn Roberts, USFWS, Arcata, CA
Elaine Rybak, USFS-R6, Portland, OR

Predictive Model Development

Robert Anthony, USGS, Corvallis, OR
Elizabeth Glenn, Oregon State Univ., Corvallis, OR
Gail Olson, USGS, Corvallis, OR
William Ripple, Oregon State Univ., Corvallis, OR



Marbled Murrelet Effectiveness Monitoring Module

Mark Huff - Module Leader, USFWS, Portland OR

Population Monitoring

Jim Baldwin, PSW, Albany, CA
Gary Falxa, USFWS, Arcata CA
Tim Max, PNW, Portland, OR
Sherri Miller, PSW, Arcata, CA
C.J. Ralph, PSW, Arcata, CA
Martin Raphael, PNW, Olympia, WA
Craig Strong, Crescent Coastal Research, Astoria, OR
Chris Thompson, WDFW, Mill Creek WA
Rich Young, USFWS, Portland OR

Habitat Monitoring

Jim Baldwin, PSW, Albany, CA
Diane Evans Mack, PNW, Olympia, WA
Sherri Miller, PSW, Arcata, CA
Kim Nelson, Oregon State University
Marty Raphael, PNW, Olympia WA
Randall Wilk, PNW, Olympia, WA
Rich Young, USFWS, Portland OR

Key Partners

Beth Gallaher, PNW, Olympia, WA
Bill Hoggeboom, PSW, Aracta, CA
Tim Max, PNW, Portland OR
Melinda Moeur, USFS-R6, Portland, OR
Barry Mulder, USFWS, Portland OR
Amanda Wilson, Oregon State University, Corvallis, OR.

Watershed Condition Monitoring Module

Steve Lanigan, Module Leader, USFS-R6, Portland OR

Peter Eldred, USFS-R6, Corvallis OR
Kirsten Gallo, BLM, Corvallis OR
Chris Moyer, BLM, Corvallis OR

Regional Interagency Advisory Team (RIAT)

Dave Busch, USGS-BRD, Portland, OR
Barry Collins, CDFG, Fortuna, CA
Bruce Davies, NWIFC, Olympia, WA
Al Doelker, BLM, Portland, OR
Dave Fuller, BLM, Arcata, CA
Joseph Furnish, USFS-R5, Vallejo, CA
Mike Furniss, PNW, Corvallis, OR
Reed Glesne, NPS, Sedro-Wolley, WA
Bob Gresswell, USGS-BRD, Corvallis, OR

Gretchen Hayslip, EPA, Seattle, WA
Dave Heller, USFS-R6, Portland, OR
Terry Hofstra, NPS, Crescent City, CA
Dave Hohler, USFS, Corvallis, OR
Phil Kaufmann, EPA, Corvallis, OR
Deborah Konnoff, USFS-R6, Portland, OR
Kim Kratz, NMFS, Portland, OR
Phil Larsen, EPA, Corvallis, OR
Steve Leider, WDFW, Olympia, WA
Rosy Mazaika, BLM, Portland, OR
Bruce McCammon, USFS-R6, Portland, OR
Bruce McIntosh, ODFW, Corvallis, OR
Joe Moreau, BLM, Portland, OR
Kathy Moynan, USFWS, Portland, OR
Tony Olsen, EPA, Corvallis, OR
Dave Powers, EPA, Corvallis, OR
Steve Ralph, EPP, Seattle, WA
John Rector, USFS-R5, Vallejo, CA
Gordie Reeves, USFS-PNW, Corvallis, OR
Keith Reynolds, USFS-PNW, Corvallis, OR
Dave Schuett-Hames, NWIFC, Olympia, WA
George Smith, Intertribal Timber Council, Portland, OR

Social and Economic Effectiveness Monitoring Module

Susan Charnley - Module Leader, PNW, Portland OR

Ellen Donoghue, PNW, Portland OR
Darryll Johnson, NPS-CESU, Seattle WA
Christina McElroy, BLM, Portland OR
Richard Phillips, USFS-R6, Portland OR
Fay Shon, USFS-R6, Portland OR
Claudia Stuart, Mendocino National Forest, Chico CA

Tribal Monitoring Module

Bruce Crespin - Module Coordinator, BLM, Portland, OR

Les McConnell, USFS-R6, Portland, OR
Sonia Tamez, USFS-R5, Vallejo, CA

Reports

Anonymous. 2002. Interagency Regional Monitoring Northwest Forest Plan - 2001 Annual Report. USDA Forest Service Pacific Northwest Region, R6-NWFP-TP-08-02. 24 p.

Implementation Monitoring Module

Baker, D, and others. 2003. Implementation Monitoring Northwest Forest Plan - 2002 Annual Summary Report. www.reo.gov/monitoring/implementation

Late-Successional and Old-growth Effectiveness Monitoring Module

Browning, J. and others. 2002. Interagency Vegetation Mapping Project (IVMP). Eastern Cascades Washington Province Version 1.0. 41 p. July 2002.
http://www.or.blm.gov/gis/projects/vegetation/ivmp/province_data.asp?id=4

Browning and others. 2002. Accuracy assessment for the Interagency Vegetation Mapping Project (IVMP). Western Cascades Oregon Province Version 2.1. 38 p. November 2002.
http://www.or.blm.gov/gis/projects/vegetation/ivmp/province_data.asp?id=7

Browning and others. 2002. Accuracy assessment for the Interagency Vegetation Mapping Project (IVMP). Western Washington Lowlands Province Version 1.0. 34 p. November 2002.
http://www.or.blm.gov/gis/projects/vegetation/ivmp/province_data.asp?id=2

Browning, J. and others. 2003. Interagency Vegetation Mapping Project (IVMP). Eastern Cascades Oregon Province Version 1.0. 45 p. January 2003.
http://www.or.blm.gov/gis/projects/vegetation/ivmp/province_data.asp?id=8

Cohen, W.B. and Spies, T.A. 1992. Estimating structural attributes of Douglas Fir/Western Hemlock forest stands from Landsat and SPOT imagery. *Remote Sens. Environ.* 41: 1-17

Cohen, W.; Spies, T.; Alig, R.; Oetter, D.; Maieresperger, T.; Fiorella, M. 2002. Characterizing 23 years (1972-1995) of stand replacement disturbance in western Oregon forests with Landsat imagery. *Ecosystems* 5: 122-137.

Levien, L.; Chris Fischer, C.; Pete Roffers, P.; Barbara Maurizi, B.; James Suero, J.; 2002. Monitoring Land Cover Changes in California. California Land Cover Mapping and Monitoring Program. Northeastern California Project Area. USDA Forest Service and California Department of Forestry and Fire Protection Cooperative Monitoring Program. 171 p. + Appendices.

Levien, L.; and others. In press. Monitoring Land Cover Changes in California. California Land Cover Mapping and Monitoring Program. North Coast Project Area. USDA Forest Service and California Department of Forestry and Fire Protection Cooperative Monitoring Program.

Moeur, M. 2002a. Late-successional and old-growth vegetation effectiveness monitoring, Northwest Forest Plan: 2001 annual summary report. http://www.reo.gov/monitoring/lisog/LSOGAnnualReport2001_04-26-02.pdf

Moeur, M. 2002b. Study Plans for Late-Successional and Old Growth (LSOG) Effectiveness Monitoring -- 2004 Interpretive Report. On file at R6 Regional Office. 24 p.

Moeur, M. 2003. Quality Assurance Project Plan (QAPP): Late-Successional and Old-Growth Vegetation (LSOG) Module, NWFP Interagency Regional Monitoring. Draft report on file at R6 Regional Office. 12 p.

O'Neil and others. 2001. Interagency Vegetation Mapping Project (IVMP). Western Washington Lowlands Province Version 1.0. 44 p. October 2001.
http://www.or.blm.gov/gis/projects/vegetation/ivmp/province_data.asp?id=2

O'Neil and others. 2002. Interagency Vegetation Mapping Project (IVMP). Western Washington Cascades Province Version 2.0. 37 p. January 2002.
http://www.or.blm.gov/gis/projects/vegetation/ivmp/province_data.asp?id=3

Waddell, K.; B. Hiserote. 2003. The PNW-FIA Integrated Database User Guide. A database of forest inventory information for California, Oregon, and Washington, Version 1.1. Forest Inventory and Analysis Program, Pacific Northwest Research Station, Portland, Oregon. Draft dated March 24, 2003.



Warbington, Ralph; Beardsley, Debby. 2002. 2002 Estimates of Old Growth Forests on the 18 National Forests of the Pacific Southwest Region. USDA Forest Service.
http://fsweb.rsl.r5.fs.fed.us/projects/oldgrowth_doc.html

Northern Spotted Owl Effectiveness Monitoring Module

Anthony, R., S. Ackers, R. Claremont, J. LaVoie, D. Giessler, N. Seaman, J. Schilling, and S. Turner-Hane. 2002a. The ecology of northern spotted owls (*Strix occidentalis caurina*) on the Willamette National Forest, Oregon†: Habitat use and demography. Annual Research Report. Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis, OR 27p.

Anthony, R., S. Andrews, F. Wagner, W. King, T. O'Brien, T. Phillips, G. Rible, and M. Shannon. 2002b. Demographic characteristics of spotted owls (*Strix occidentalis caurina*) in the southern Oregon Cascades. Annual Research Report. Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Corvallis, OR 24p.

Anthony, R. G., G. S. Olson, S. Ackers, E. Forsman, W. J. Ripple and E. M. Glenn. 2002c. Predicting abundance and demographic performance of northern spotted owls from vegetative characteristics†: Report on results of western Oregon Cascades- H.J. Andrews Experimental Forest. Unpublished Annual Report. Oregon Cooperative Wildlife Research Unit, Oregon State University, Corvallis, OR 57p.

Forsman, E. D., R. G. Anthony, J. A. Reid, P. J. Loschl, S. G. Sovern, M. Taylor, B. L. Biswell, A. Ellingson, E. C. Meslow, G. S. Miller, K. A. Swindle, J. A. Thrailkill, F. F. Wagner, and D. E. Seaman. 2002a. Natal and breeding dispersal of northern spotted owls. Wildlife Monograph. No. 149.

Forsman, E., J. Reid, S. Graham, J. Mowdy, and A. Price. 2002b. Demographic characteristics of northern spotted owls (*Strix occidentalis*) on the Tyee study area, Roseburg, Oregon†: 1985-2002. Annual Report. USDA Pacific Northwest Research Station, Corvallis, OR 12p.

Forsman, E., P. Loschl, C. McCafferty, T. Snetsinger, M. Larsson, B. Meiring, D. Rosenthal, and D. Lindley. 2002c. Demographic characteristics of spotted owls in the Oregon Coast Ranges, 1990-2002. Annual Report. USDA Pacific Northwest Research Station, Corvallis, OR 22p.

Forsman, E., S. Sovern, and M. Taylor. 2002d. Demography of spotted owls on the east slope of the Cascade Range, Washington, 1989-2002. Annual Progress Report. USDA Pacific Northwest Research Station, Corvallis, OR. 25p.

Gremel, S. 2002. Spotted Owl Monitoring in Olympic National Park: 2002 Annual Report. Olympic National Park. Port Angeles, WA 13 p.

Lint, J., R. Horn, F. Oliver, C. Larson, K. Krause, M. O'Hara, M. Oleri, H. Wise, M. Irwin, K. Fukuda, and Phil Colvard. 2003. Demographic characteristics of northern spotted owls (*Strix occidentalis caurina*) in the Klamath Mountains Province of Oregon, 1983-2002. Annual Report, FY2002. Roseburg District, Bureau of Land Management, Roseburg, OR 7p.

Olson, G. S., R. G. Anthony, E. M. Glenn, E. Forsman, J. A. Reid, and W. J. Ripple. In prep. Demographic performance of northern spotted owls in relation to landscape cover types in the central Oregon Coast Range.

Marbled Murrelet Effectiveness Monitoring Module

Meyer, C.B.; Miller, S.L.; Ralph, C.J. 2002. Multi-scale landscape and seascape patterns associated with marbled murrelet nesting areas on the U.S. west coast. *Landscape Ecology* 17: 95-115.

Miller, S.L.; Meyer, C.B.; and Ralph, C.J. 2002. Land and seascape patterns associated with marbled murrelet abundance offshore. *Waterbirds* 25(1): 100-108.

Raphael, M.G.; Mack, D.E.; Marzluff, J.M.; Luginbuhl, J.M. 2002. Effects of forest fragmentation on populations of the marbled murrelet. *Studies in Avian Biology* No. 22: 221-235.

Strong, C.S. 2003. Status of marbled murrelets at sea in conservation zone 5: Mendocino, Sonoma, and Marin counties. Final Report to U.S. Fish and Wildlife Service and California Department of Fish and Game. 23 p.

Reports (cont.)

Strong, C.S. 2003. Marbled murrelet abundance and reproductive indices in Oregon during 2002. Annual Report to the Oregon Department of Fish and Wildlife, and U.S. Fish and Wildlife Service. 14 p.

Watershed Condition Monitoring Module

Gallo, K., C. Moyer, and S. Lanigan. 2003. Aquatic and riparian effectiveness monitoring program. 2002 Annual Report. Corvallis, OR

Lanigan, S. 2002. Monitoring Watershed Health. State-Federal Monitoring Partnership, Sept 2002 Progress Overview. Aquatic and Riparian Effectiveness Program (AREMP), Corvallis OR.
<http://www.reo.gov/monitoring/reports.htm#watershed>

Lanigan, S. (editor). 2002. Habitat attribute protocols - based on agency input and website info (9/20/02). Aquatic and Riparian Effectiveness Program (AREMP), Corvallis OR.
<http://www.reo.gov/monitoring/reports.htm#watershed>

Gallo, K. 2002. Field Protocol Synopsis, Regional Interagency Monitoring Aquatic and Riparian Effectiveness Monitoring Program for the Northwest Forest Plan. Field Season 2002. Aquatic and Riparian Effectiveness Program (AREMP), Corvallis OR. <http://www.reo.gov/monitoring/reports.htm#watershed>

A series of papers from the November, 2002 "Large Scale Watershed Monitoring Workshop" are posted at www.reo.gov/monitoring/watershed.

Social and Economic Effectiveness Monitoring Module

Donoghue, Ellen. 2003. Delimiting communities in the Pacific Northwest. USDA Forest Service, Pacific Northwest Research Station General Technical Report 570. (available online at www.fs.fed.us/pnw)

Donoghue, Ellen M. and Haynes, Richard W. 2002. Assessing the viability and adaptability of Oregon communities. Gen Tech Rep. PNW-GTR-549. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station.

Jackson, Elizabeth, Lee, Robert G., and Sommers, Paul. 2002. Monitoring the Community Impacts of the Northwest Forest Plan: Alternative Methodologies. Final Technical Report. Seattle, WA: USGS Forest and Rangeland Ecosystem Science Center, Cascadia Field Station, and College of Forest Resources, University of Washington. July 2002.

Moseley, Cassandra, and Wilson, Lisa J. 2002. Multiparty Monitoring for Sustainable Resource Management. Eugene, OR: Watershed Research and Training Center and Ecosystem Workforce Program, University of Oregon. December 2002.

Sommers, Paul. 2001. Monitoring Socioeconomic Change in the Northern Spotted Owl Region: Framework, Trends, and Community Level Monitoring Recommendations. Technical Report. Seattle, WA: USGS Forest and Rangeland Ecosystem Science Center, Cascadia Field Station, and College of Forest Resources, University of Washington. February 2001.

Sommers, Paul, Lee, Robert G., and Jackson, Elizabeth. 2002. Monitoring Economic and Social Change in the Northern Spotted Owl Region: Phase II Developing and Testing an Indicators Approach. Draft Technical Report. Seattle, WA: USGS Forest and Rangeland Ecosystem Science Center, Cascadia Field Station, and College of Forest Resources, University of Washington. January 2002.

Stuart, C. 2003. Social and economic effectiveness monitoring, Northwest Forest Plan, 2002 Annual Summary Report. www.reo.gov/monitoring/socio

Tribal Monitoring Module

Pacific Management Associates. 2000. Consultation with tribal governments under Northwest Forest Plan. Pilot Study report. 35p. www.reo.gov/monitoring/tribal

Acknowledgements: Graphic design - Gail Saunders-Boyle, USFS-R6